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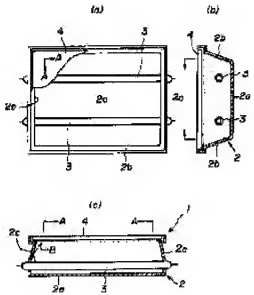
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To illuminate a liquid crystal panel with a uniform luminance distribution by compensating a luminance reduction in both end areas of linear light sources in a liquid crystal display device in which directly under type back light is used.

SOLUTION: A liquid crystal panel and a rear illuminating light source 1 emitting illuminating light by being provided on the back surface of the liquid crystal panel are at least provided with a frame 2 having side walls 2b, 2c rising from respective one pair of the opposed parallel end edges 2b of a roughly rectangular bottom part 2a in the direction of the liquid crystal panel, linear light sources 3 attached by making it extend along the direction parallel with the one side 2b of one pair of side walls of the inner bottom part of the frame 2 and a light diffusing plate 4 inserted between the linear light sources 3 and the liquid crystal panel, have inclined planes in the directions in which the insides of one pair of the side walls 2b in the direction parallel with the linear light sources 3 of the frame 2 open from the bottom part 2a toward the liquid crystal panel and have inclined planes in the directions in which the insides of one pair of side walls 2c in the direction perpendicular to the light sources 3 close from the bottom part 2a toward the liquid crystal panel.



LEGAL STATUS

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[Patent number]

[Date of registration]

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CLAIMS

[Claim(s)]
[Claim 1] In the liquid crystal display possessing a liquid crystal panel and the source of the tooth-back illumination light which installs in the rear face of this liquid crystal panel, and carries out outgoing radiation of the illumination light said source of the tooth-back illumination light The frame which has the side attachment wall which starts in said direction of a liquid crystal panel from a pair each of parallel edges which the pars basilaris ossis occipitalis of an abbreviation rectangle counters, The linear light source which it was made to extend in the direction parallel to one side of the side attachment wall of said pair of the inner pars basilaris ossis occipitalis of this frame, and was attached, The liquid crystal display characterized by having the inclined plane of the direction of the side attachment wall of the pair of the direction which is equipped with said linear light source and the optical diffusion plate inserted between said liquid crystal panels at least, and intersects perpendicularly with said linear light source which the inside closes towards said direction of a liquid crystal panel from said pars basilaris ossis occipitalis at least.
[Claim 2] The liquid crystal display according to claim 1 characterized by having the reflective member of the **** Yamagata configuration of having two or more said linear light sources, and having the reflector which reflects the light from each linear light source concerned in said direction of a liquid crystal panel between the extension directions of each linear light source.
[Claim 3] The liquid crystal display according to claim 1 or 2 characterized by equipping the upper part of said linear light source with protection-from-light / reflective means for equalizing the luminous-intensity distribution from the linear light source concerned.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a liquid crystal display, especially relates to the liquid crystal display equipped with the source of the tooth-back illumination light without brightness unevenness by high brightness.
[0002]
[Description of the Prior Art] In recent years, the so-called liquid crystal display which used the liquid crystal panel for the display device as a monitor of picture reproducer or various information terminals is used abundantly.
[0003] The passive-matrix mold known as a STN mold and the active-matrix mold using non-line type components, such as TFT, are common to this liquid crystal display as that liquid crystal panel.
[0004] These liquid crystal panels need the source of the illumination light separately, in order to visualize the image formed in the liquid crystal panel since it was not a self-luminescence mold. The visible image is formed in there being a transparency mold and a reflective mold in a liquid crystal panel, and many liquid crystal panels of a transparency mold being used for high brightness and a high contrast display, installing the source of the tooth-back illumination light (it also being hereafter called a back light) in that rear face by the monitor for information terminals, and becoming irregular by the image which formed the light from this back light in the liquid crystal panel.
[0005] With the liquid crystal display built in information machines and equipment, the field-like illumination light has been obtained by installing the linear light source of a cold cathode fluorescent lamp etc. in the side face of the transparent plate called a light guide plate, and making a light guide plate spread the light from the light source concerned for the lightweight[a thin shape and]-izing.
[0006] However, there is an inclination which uses a liquid crystal display as a monitor of the stand-alone type which replaces CRT in recent years, and since the need of considering especially as a thin shape was lost, and in order to cope with a raise in brightness, and enlargement, the back light of the direct lower part type which arranges the direct light source is adopted as the rear face of a liquid crystal panel.
[0007] And arranging two or more linear light sources is performed as a way stage for improving the brightness of the back light of direct female mold.
[0008] The back light using a linear light source is held in the frame which has the side attachment wall which starts in said direction of a liquid crystal panel from a pair each of parallel edges which the pars basilaris ossis occipitalis of an abbreviation rectangle counters, and is installed in the tooth back of a liquid crystal panel. And usually it has the optical diffusion plate for equalizing the luminance distribution of the illumination light between a liquid crystal panel and a linear light source.
[0009] Drawing 11 is a mimetic diagram explaining the conventional example of a configuration of the liquid crystal display equipped with the direct female mold back light, and the fragmentary sectional view explaining the condition of (a) having built the back light of (a) into the expansion perspective view of only a back light, and having built (b) in the liquid crystal panel of a linear light source and the

direction of a right angle, and (c) show the linear light source of (a), and a parallel fragmentary sectional view.

[0010] As shown in this drawing (a), the back light 1 of direct female mold Side-attachment-wall 2b which starts in said direction of a liquid crystal panel from a pair each of parallel edges which rectangular bottom plate 2a counters, and the frame 2 which has 2c, It has at least the linear light source which it was made to extend in the direction parallel to one side of side-attachment-wall 2b of said pair of the inner pars basilaris ossis occipitalis of bottom plate 2a of this frame 2, and was attached, said linear light source, and the optical diffusion plate 4 inserted between said liquid crystal panels.

[0011] A linear light source 3 is a cold cathode fluorescent lamp, and it is installed in other side-attachment-wall 2bs and parallel along with base 2a so that side-attachment-wall 2c may be built over the two.

[0012] The condition of having installed this back light 1 in the tooth back of a liquid crystal panel 5 is shown in this drawing (b) and (c). A liquid crystal panel 5 pinches liquid crystal layer 5e between two transparence substrates (glass plate) 5a and 5b, carries out the laminating of the polarizing plates 5c and 5d to the field of the upper limit, and is constituted. In addition, any of active-matrix molds, such as passive-matrix molds, such as STN, or TFT, are sufficient as this liquid crystal panel, and the laminating of other optical compensation films etc. is carried out according to form.

[0013] As shown in this drawing (b), the inside is made into a reflector at least, and the linear light source 3 of a frame 2, bottom plate 2a, and parallel side-attachment-wall 2b reflect the light from the linear light source concerned in the liquid crystal panel 5 direction, and are planning use effectiveness of light.

[0014] On the other hand, at least, as shown in this drawing (c), although an inside is as a reflector of the linear light source 3 of a frame 2, and right-angled side-attachment-wall 2c where the front face is the same, it considers as the vertical plane to the liquid crystal panel 5.

[0015]

[Problem(s) to be Solved by the Invention] Although the inside is raising the use effectiveness of the light from a linear light source at least as a configuration of the side attachment wall of a pair parallel to the linear light source of the frame which constitutes a back light opened in the direction of a liquid crystal panel from the edge of the frame concerned as described above Since the linear light source and the side attachment wall of a right-angled pair are made still perpendicular to the direction of a liquid crystal panel, the reflected light in this perpendicular side attachment wall will advance on the outside of the effective viewing area of a liquid crystal panel, as the arrow head B in drawing showed.

[0016] The luminescence luminance distribution in alignment with the longitudinal direction does not become uniform [the linear light source of a cold cathode fluorescent lamp etc.], but brightness is falling near [the] both ends.

[0017] Therefore, the display brightness of the liquid crystal panel which counters near the longitudinal direction edge of a linear light source fell, and there was a problem that uniform luminance distribution could not be acquired.

[0018] The purpose of this invention is to offer the liquid crystal display which cancels the trouble of the above-mentioned conventional technique, compensates a brightness fall in the both-ends field of a linear light source, and illuminated the liquid crystal panel to homogeneity.

[0019]

[Means for Solving the Problem] The above-mentioned purpose is attained by [of the side attachment wall of the frame in the both-ends field of a linear light source] making an inside incline in the frame inside at least.

[0020] That is, this invention has the description at the point considered as the configuration of following the (1) - (3).

[0021] (1) Said source of the tooth-back illumination light of the liquid crystal display possessing a liquid crystal panel and the source of the tooth-back illumination light which installs in the rear face of this liquid crystal panel, and carries out outgoing radiation of the illumination light The frame which has the side attachment wall which starts in said direction of a liquid crystal panel from a pair each of

parallel edges which the pars basilaris ossis occipitalis of an abbreviation rectangle counters, The linear light source which it was made to extend in the direction parallel to one side of the side attachment wall of said pair of the inner pars basilaris ossis occipitalis of this frame, and was attached, It has at least said linear light source and the optical diffusion plate inserted between said liquid crystal panels. While having the inclined plane of the direction of the side attachment wall of the pair of a direction parallel to said linear light source of said frame which the inside opens towards said direction of a liquid crystal panel from said pars basilaris ossis occipitalis at least It is characterized by having the inclined plane of the direction of the side attachment wall of the pair of the direction which intersects perpendicularly with said linear light source which the inside closes towards said direction of a liquid crystal panel from said pars basilaris ossis occipitalis at least.

[0022] It is characterized by having the reflective member of the **** Yamagata configuration of having two or more said linear light sources in (2) and (1), and having the reflector which reflects the light from each linear light source concerned in said direction of a liquid crystal panel between the extension directions of each linear light source.

[0023] It is characterized by equipping the upper part of said linear light source in (3), (1), or (2) with protection-from-light / reflective means for equalizing the luminous-intensity distribution from the linear light source concerned.

[0024] In addition, the number of the linear light sources in the above-mentioned configuration one, and they are good also as three or more. Moreover, the above-mentioned protection-from-light / reflective means makes a part of light penetrate in the direction of a liquid crystal panel, has the function to reflect a part of light in the opposite side with a liquid crystal panel, and it can make it many shape of a dot which gave gradation which the amount which shades and reflects the light from a linear light source dwindles, and the shape of a thin line of an a large number book as it separates from the longitudinal direction core of a linear light source.

[0025]

[Embodiment of the Invention] Hereafter, with reference to an example, it explains to a detail about the gestalt of operation of this invention.

[0026] Drawing 1 is a mimetic diagram explaining the configuration of the back light of the 1st example of the liquid crystal display by this invention, and the sectional view of the linear light source explaining the condition of (a) having built the back light of (a) into the plan, and having built (b) in the liquid crystal panel, and the direction of a right angle, and (c) show the linear light source of (a), and a parallel sectional view.

[0027] In this drawing, a sign 1 shows the whole back light and, for a frame and 2a, a pars basilaris ossis occipitalis, a side attachment wall with 2b parallel to a linear light source, and 2c of a linear light source, a right-angled side attachment wall, and 3 are [2 / a linear light source (cold cathode fluorescent lamp) and 4] optical diffusion plates. In addition, illustration is omitted although the laminating of the liquid crystal panel is carried out above the optical diffusion plate 4.

[0028] In this example, two linear light sources 3 are installed and the inside of base 2a of a frame 2, side-attachment-wall 2b, and 2c is made into the reflector.

[0029] Side-attachment-wall 2b of a pair parallel to a linear light source has the inclined plane of the direction which the inside opens towards the direction of a liquid crystal panel (optical diffusion plate 4 direction) from said pars-basilaris-ossis-occipitalis 2a like said drawing 11 .

[0030] And the inside of side-attachment-wall 2c of the pair of the direction which intersects perpendicularly with a linear light source 3 is formed so that it may have the inclined plane of the direction closed towards the direction of a liquid crystal panel from pars-basilaris-ossis-occipitalis 2a.

[0031] Thereby, the light reflected by this side-attachment-wall 2c can advance in the effective viewing area of a liquid crystal panel, can compensate the lack of the quantity of light of the edge of a linear light source 3, can raise brightness, and can acquire uniform luminance distribution.

[0032] Drawing 2 is a linear light source explaining the configuration of the back light of the 2nd example of the liquid crystal display by this invention, and a parallel important section sectional view.

[0033] Although the side attachment wall of a pair parallel to a linear light source 3 has the inclined

plane of the direction which that inside opens towards the direction of a liquid crystal panel (optical diffusion plate 4 direction) from said pars-basilaris-ossis-occipitalis 2a like the 1st example in this example, the inside of side-attachment-wall 2c of the pair of the direction which intersects perpendicularly with a linear light source 3 is formed so that it may have the curved surface of the direction closed towards the direction of a liquid crystal panel from pars-basilaris-ossis-occipitalis 2a.
[0034] Thereby, the light reflected by side-attachment-wall 2c of this curved surface can advance in the effective viewing area of a liquid crystal panel, can compensate the lack of the quantity of light of the edge of a linear light source 3, can raise brightness, and can acquire uniform luminance distribution.
[0035] Drawing 3 is a linear light source explaining the configuration of the back light of the 3rd example of the liquid crystal display by this invention, and a parallel important section sectional view.
[0036] Although the side attachment wall of a pair parallel to a linear light source 3 has the inclined plane of the direction which that inside opens towards the direction of a liquid crystal panel (optical diffusion plate 4 direction) from pars-basilaris-ossis-occipitalis 2a like the 1st and 2nd examples also in this example Although the part of the inside of side-attachment-wall 2c of the pair of the direction which intersects perpendicularly with a linear light source 3 is perpendicular to the direction of a liquid crystal panel the middle, it is formed so that it may have after that the inclined plane of the direction closed towards the direction of a liquid crystal panel.
[0037] Thereby, the light reflected by side-attachment-wall 2c of this curved surface can advance in the effective viewing area of a liquid crystal panel, can compensate the lack of the quantity of light of the edge of a linear light source 3, can raise brightness, and can acquire uniform luminance distribution.
[0038] Drawing 4 is the important section sectional view explaining the configuration of the back light of the 4th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[0039] The side attachment wall of a pair with this example parallel to the linear light source 3 of a frame 2 It has the inclined plane of the direction which the inside opens towards the direction of a liquid crystal panel (optical diffusion plate 4 direction) from said pars-basilaris-ossis-occipitalis 2a like the 1st example. While the inside of side-attachment-wall 2c of the pair of the direction which intersects perpendicularly with a linear light source 3 is made into the inclined plane or curved surface of a direction closed towards the direction of a liquid crystal panel from the same pars-basilaris-ossis-occipitalis 2a as any of drawing 1 , drawing 2 , or drawing 3 they are It has the reflective member (Yamagata pier) 6 of the Yamagata configuration which has the reflector which reflects the light from each linear light source 3 concerned in the direction of a liquid crystal panel between two linear light sources 3 installed in the pars-basilaris-ossis-occipitalis 2a concerned.
[0040] By having formed this Yamagata pier 6, it becomes possible to compensate the lack of brightness between two linear light sources, and to acquire still more uniform illumination-light distribution. In addition, the homogeneity illumination-light distribution of the configuration of the Yamagata pier 6 improves more not only on a linear ramp but on a curved-surface inclination.
[0041] Drawing 5 is the important section sectional view explaining the configuration of the back light of the 5th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[0042] The side attachment wall of a pair with this example parallel to the linear light source 3 of a frame 2 It has the inclined plane of the direction which the inside opens towards the direction of a liquid crystal panel (optical diffusion plate 4 direction) from said pars-basilaris-ossis-occipitalis 2a like the 1st example. While the inside of side-attachment-wall 2c of the pair of the direction which intersects perpendicularly with a linear light source 3 is made into the inclined plane or curved surface of a direction closed towards the direction of a liquid crystal panel from the same pars-basilaris-ossis-occipitalis 2a as any of drawing 1 , drawing 2 , or drawing 3 they are A linear light source and parallel are equipped with the reflective member (Yamagata pier) 6 which has the reflector which reflects the light from each linear light source 3 concerned in the direction of a liquid crystal panel between two linear light sources 3 installed in the pars-basilaris-ossis-occipitalis 2a concerned like the 4th example. And protection-from-light / reflective member 7 for shading a part of light from the linear light source 3

concerned in the upper part of a linear light source 3 further, and making it reflect in a frame 2 side is formed.
[0043] The above-mentioned protection-from-light / reflective member 7 is formed by putting thin films, such as an aluminum ingredient, on the optical diffusion plate 4 by printing etc. the shape of a dot, and in the shape of a thin line.
[0044] By having formed this protection-from-light / reflective member 7, it becomes possible to control too much upper brightness of two linear light sources, and to acquire still more uniform illumination-light distribution.
[0045] Moreover, the luminance distribution of the more uniform illumination light can be acquired by forming the Yamagata pier 6. In addition, it is not indispensable to have formed the Yamagata pier 6 in this example.
[0046] Drawing 6 is the important section sectional view explaining the configuration of the back light of the 6th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[0047] When it was a liquid crystal display with large size, the number of a linear light source needed to be made to increase, and four linear light sources 3 were installed in this example.
[0048] This example is the same as said 4th example except for the point which the number of a linear light source 3 increased.
[0049] Moreover, drawing 7 is the important section sectional view explaining the configuration of the back light of the 7th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[0050] This example forms protection-from-light / reflective member 7 for being the same as that of said 5th example, shading a part of light from the linear light source 3 concerned in the upper part of each linear light source 3 except for the point which the number of a linear light source 3 increased like the 6th example, and making it reflect in a frame 2 side.
[0051] The effectiveness of the 6th and 7th examples of the above is the same as said 4th and 5th examples respectively.
[0052] drawing 8 shows an example of protection-from-light / reflective member formed in the optical diffusion plate of the 5th and 7th examples -- it is a top view a part and C-C corresponds focusing on the longitudinal direction of a linear light source.
[0053] this protection-from-light / reflective member 7 -- a C-C top -- the dot of a major diameter -- it is -- the line concerned from this C-C line -- it considers as the dot of a minor diameter in the direction which separates from a beam of light.
[0054] The luminance distribution of the light which carries out outgoing radiation in the direction of a liquid crystal panel with the magnitude and spacing of this dot can amend the property which decreases as it came to be shown in (a), the luminance distribution of a linear light source showed (b) and it separates from a center line right and left, and can make it uniform luminance distribution as shown in (c).
[0055] Drawing 9 and drawing 10 are the luminance distribution property Figs. to 50mm at the longitudinal direction inside of the side-attachment-wall lower part of the direction of a right angle to the linear light source of the frame for explaining the effectiveness of the example of this invention, and a linear light source.
[0056] Drawing 9 shows the characteristic curve B at the time of making the side attachment wall concerned the distance of the pars basilaris ossis occipitalis of a diffusion plate and a frame incline 3mm like said 1st example in an effective viewing-area side from a conventional characteristic curve A and the conventional side-attachment-wall lower part with perpendicular 20mm and side attachment wall concerned, and the characteristic curve C at the time of making it incline 5mm.
[0057] It turns out that the brightness of the edge of the linear light source concerned rises characteristic curves B and C by making the side attachment wall of a linear light source and the direction of a right angle incline like said example as compared with a characteristic curve A.
[0058] Moreover, drawing 10 shows the characteristic curve measured on the same inclination

conditions as drawing 9 when doubling when the optical diffusion plate side edge section of the side attachment wall of a linear light source and the direction of a right angle is made perpendicular [the former].

[0059] Also in this case, it turns out that the brightness of the edge of the linear light source concerned rises characteristic curves B and C by making the side attachment wall of a linear light source and the direction of a right angle incline like said example as compared with a characteristic curve A.

[0060] Moreover, this drawing B' and C' show the characteristic curve at the time of making the side attachment wall of a linear light source and the direction of a right angle incline on the way like said 3rd example. Although the brightness of the edge of the linear light source concerned carries out a fall a little also in [C / B and] this case, it turns out that it goes up from the conventional A.

[0061] Thus, according to each example, a brightness fall in the both-ends field of a linear light source is compensated.

[0062]

[Effect of the Invention] As explained above, according to this invention, the low brightness in the edge of the linear light source in the liquid crystal display using the back light of the direct female mold which equipped the tooth back of a liquid crystal panel with 1 or two or more linear light sources can be compensated, and the image display of high quality can be obtained for the brightness of the display screen as uniform distribution.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a mimetic diagram explaining the configuration of the back light of the 1st example of the liquid crystal display by this invention.
[Drawing 2] They are a linear light source explaining the configuration of the back light of the 2nd example of the liquid crystal display by this invention, and a parallel important section sectional view.
[Drawing 3] They are a linear light source explaining the configuration of the back light of the 3rd example of the liquid crystal display by this invention, and a parallel important section sectional view.
[Drawing 4] It is the important section sectional view explaining the configuration of the back light of the 4th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[Drawing 5] It is the important section sectional view explaining the configuration of the back light of the 5th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[Drawing 6] It is the important section sectional view explaining the configuration of the back light of the 6th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[Drawing 7] It is the important section sectional view explaining the configuration of the back light of the 7th example of the liquid crystal display by this invention of a linear light source and the rectangular direction.
[Drawing 8] an example of protection-from-light / reflective member formed in the optical diffusion plate of the 5th and 7th examples is shown -- it is a top view a part.
[Drawing 9] It is a luminance distribution property Fig. to 50mm at the longitudinal direction inside of the side-attachment-wall lower part of the direction of a right angle to the linear light source of the frame for explaining the effectiveness of the example of this invention, and a linear light source.
[Drawing 10] It is a luminance distribution property Fig. to 50mm at the longitudinal direction inside of the side-attachment-wall upper part of the direction of a right angle to the linear light source of the frame for explaining the effectiveness of the example of this invention further, and a linear light source.
[Drawing 11] It is a mimetic diagram explaining the conventional example of a configuration of the liquid crystal display equipped with the direct female mold back light.
[Description of Notations]
1 Back Light
2 Frame of Back Light
2a Pars basilaris ossis occipitalis
2b A side attachment wall parallel to a linear light source
2c A linear light source and a right-angled side attachment wall
3 Linear Light Source (Cold Cathode Fluorescent Lamp)
4 Optical diffusion plate.
5 Liquid Crystal Panel

6 Yamagata Pier
7 Protection-from-light / reflective member.

[Translation done.]

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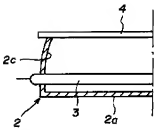
DRAWINGS

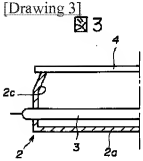
[Drawing 2]

図2



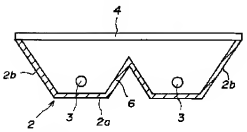
[Drawing 3]

図3



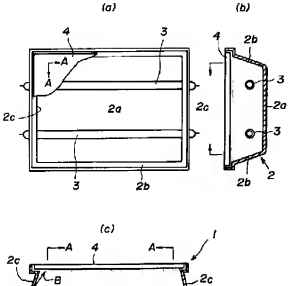
[Drawing 4]

図4



[Drawing 1]

図1



[Drawing 5]

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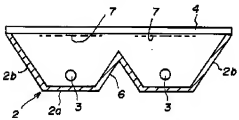

[Drawing 6]

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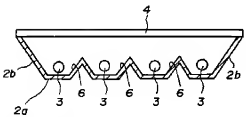
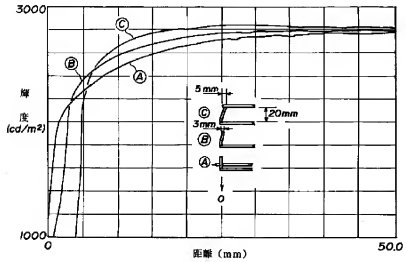


[Drawing 7]

図7

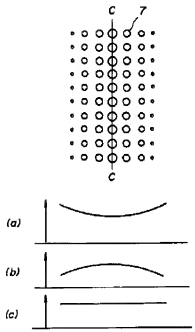
[Drawing 9]

図9



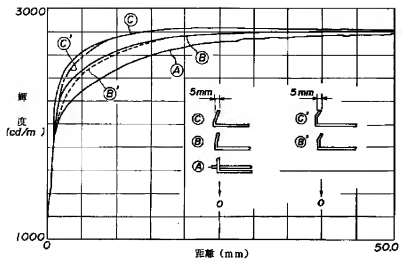
[Drawing 8]

図8



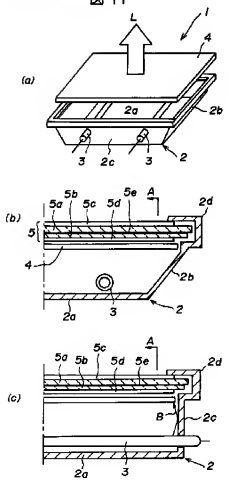
[Drawing 10]

図 10



[Drawing 11]

図 11



[Translation done.]

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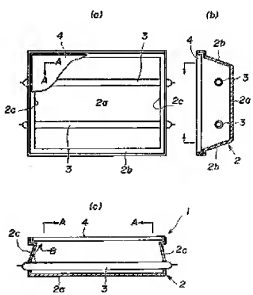
(54)【発明の名称】　液晶表示装置

(57)【要約】
【課題】直下型バックライトを用いた液晶表示装置における線状光源の両端領域での輝度低下を補償して液晶パネルを均一な輝度分布で照明する。
【解決手段】液晶パネルと　この液晶パネルの裏面に設置して照明光を出射する背面照明光源１は、矩形の底部２ａの対向する各一対の平行辺縁２ｂから液晶パネル方向に立ち上がる側壁２ｂ、２ｃを有するフレーム２と　このフレーム２の内底部の前記一対の側壁の一方２ｂと平行な方向に延在させて取り付けた線状光源３と、線状光源３と液晶パネルの間に介挿した光拡散板４とを少なくとも備え、フレーム２の線状光源３と平行な方向の一対の側壁２ｂの内側が底部２ａから液晶パネル方向に向けて開く方向の傾斜面を有すると共に、線状光源３と直交する方向の一対の側壁２ｃの内側が底部２ａから液晶パネル方向に向けて閉じる方向の傾斜面とした。

図１



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【特許請求の範囲】

【請求項１】液晶パネルと、この液晶パネルの裏面に設置して照明光を出射する背面照明光源とを具備する液晶表示装置において、

前記背面照明光源は、略矩形の底部の対向する各一対の平行端縁から前記液晶パネル方向に立ち上がる側壁を有するフレームと、このフレームの内底部の前記一対の側壁の一方と平行な方向に延在させて取り付けた線状光源と、前記線状光源と前記液晶パネルの間に介挿した光拡散板とを少なくとも備え

前記線状光源と直交する方向の一対の側壁の少なくとも内側が前記底部から前記液晶パネル方向に向けて閉じる方向の傾斜面を有することを特徴とする液晶表示装置。

【請求項２】前記線状光源を複数有し、各線状光源の延在方向の間に当該各線状光源からの光を前記液晶パネル方向に反射する反射面を有する略々山形形状の反射部材を備えることを特徴とする請求項１に記載の液晶表示装置。

【請求項３】前記線状光源の上部に、当該線状光源からの光の強度分布を平均化するための遮光・反射手段を備えることを特徴とする請求項１または２に記載の液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶表示装置に係り、特に高輝度で輝度むらのない背面照明光源を備えた液晶表示装置に関する。

【０００２】

【従来の技術】近年、画像再生装置や各種情報端末機のモニターとしての表示デバイスに、液晶パネルを用いた所謂液晶表示装置が多用されている。

【０００３】この液晶表示装置には、その液晶パネルとして、ＳＴＮ型として知られる単純マトリクス型と、ＴＦＴ等の非線型素子を用いたアクティブ・マトリクス型とが一般的である。

【０００４】これらの液晶パネルは自己発光型でないため、液晶パネルに形成した画像を可視化するためには別途に照明光源を必要とする。液晶パネルには、透過型と反射型とがあり、情報端末用モニター等では、高輝度と高コントラスト表示のために透過型の液晶パネルが多く用いられ、その裏面に背面照明光源（以下、バックライトとも称する）を設置して、このバックライトからの光を液晶パネルに形成した画像で変調することで可視画像を形成している。

【０００５】情報機器に内蔵される液晶表示装置では、その薄型・軽量化のために、導光板と呼ばれる透明な板状体の側面に冷陰極蛍光灯等の線状光源を設置し、当該光源からの光を導光板に伝播させることで面状の照明光を得ている。

【０００６】しかし、近年、ＣＲＴに代わるスタンドアローンタイプのモニターとして液晶表示装置を採用する傾向があり、特に薄型とする必要が無くなったために、また、高輝度化と大型化が対応するために、液晶パネルの裏面に直接光源を配置する直下方式のバックライトが採用されるようになっている。

【０００７】そして、直下型のバックライトの輝度を向上するための一手段として、線状光源を複数本配置することが行われる。

【０００８】線状光源を用いたバックライトは、略矩形の底部の対向する各一対の平行端縁から前記液晶パネル方向に立ち上がる側壁を有するフレームに収容されて液晶パネルの背面に設置される。そして、液晶パネルと線状光源との間に照明光の輝度分布を均一化するための光拡散板とを備えているのが普通である。

【０００９】図１１は直下型バックライトを備えた液晶表示装置の従来の構成例を説明する模式図であって、（ａ）はバックライトのみの展開斜視図、（ｂ）は（ａ）のバックライトを液晶パネルに組み込んだ状態を説明する線状光源と直角方向の部分断面図、（ｃ）は（ａ）の線状光源と平行方向の部分断面図を示す。

【００１０】同図（ａ）に示したように、直下型のバックライト１は、矩形の底板２ａの対向する各一対の平行端縁から前記液晶パネル方向に立ち上がる側壁２ｂと２ｃを有するフレーム２と、このフレーム２の底板２ａの内底部の前記一対の側壁２ｂの一方と平行な方向に延在させて取り付けた線状光源と、前記線状光源と前記液晶パネルの間に介挿した光拡散板４とを少なくとも備えている。

【００１１】線状光源３は冷陰極蛍光灯であり、その２本を側壁２ｃに指付めたすように他の側壁２ｂと平行に底面２ａに沿って設置されている。

【００１２】このバックライト１を液晶パネル５の背面に設置した状態を同図（ｂ）（ｃ）に示す。液晶パネル５は２枚の透明基板（ガラス板）５ａと５ｂの間に液晶層５ｅを狭持し、その上側の面に偏光板５ｃと５ｄを積層して構成されている。なお、この液晶パネルはＳＴＮ等の単純マトリクス型、またはＴＦＴ等のアクティブマトリクス型の何れでもよく、型式に応じて他の光補償フィルム等が積層されている。

【００１３】同図（ｂ）に示したように、フレーム２の線状光源３と底板２ａ、そして平行な側壁２ｂは、少なくともその内面が反射面とされ、当該線状光源からの光を液晶パネル５方向に反射させ、光の利用効率を図っている。

【００１４】一方、同図（ｃ）に示したように、フレーム２の線状光源３と直角な側壁２ｃの少なくとも内面は、その表面が同様の反射面とされているが、液晶パネル５に対して垂直面とされている。

【００１５】

【発明が解決しようとする課題】上記したように、バッ

クライトを構成するフレームの線状光源と平行な一対の側壁の少なくともその内面は、当該フレームの端縁から液晶パネル方向に開いた形状として、線状光源からの光の利用効率を向上させているが、線状光源と直角な一対の側壁は液晶パネル方向に垂直のままとされているため　この垂直な側壁での反射光は図中の矢印Ｂで示したように液晶パネルの有効表示領域の外側に進行してしまう。

【００１６】冷陰極蛍光灯等の線状光源は、その長手方向に沿う発光輝度分布が一様とはならず、その両端付近では輝度が低下している。

【００１７】そのため、線状光源の長手方向端部近傍に対向する液晶パネルの表示輝度が低下し、均一な輝度分布を得ることが出来ないという問題があった。

【００１８】本発明の目的は、上記従来技術の問題点を解消し、線状光源の両端領域での輝度低下を補償して液晶パネルを均一に照明するようにした液晶表示装置を提供することにある。

【００１９】

【課題を解決するための手段】上記目的は、線状光源の両端領域にあるフレームの側壁の少なくとも内面をフレーム内側に傾斜させることによって達成される。

【００２０】すなわち、本発明は、下記（１）～（３）の構成とした点に特徴を有する。

【００２１】（１）液晶パネルと、この液晶パネルの裏面に設置して照明光を出射する背面照明光源とを具備する液晶表示装置の前記背面照明光源が、略矩形の底部の対向する各一対の平行端縁から前記液晶パネル方向に立ち上がる側壁を有するフレームと、このフレームの底部の前記一対の側壁の一方と平行な方向に延在させて取り付けた線状光源と、前記線状光源と前記液晶パネルの間に介挿した光拡散板とを少なくとも備え、前記フレームの前記線状光源と平行な方向の一対の側壁の少なくとも内面が前記底部から前記液晶パネル方向に向けて開く方向の傾斜面を有すると共に、前記線状光源と直交する方向の一対の側壁の少なくとも内側が前記底部から前記液晶パネル方向に向けて閉じる方向の傾斜面を有することを特徴とする。

【００２２】（２）（１）における前記線状光源を複数有し　各線状光源の延在方向の間に当該各線状光源からの光を前記液晶パネル方向に反射する反射面を有する略ＶＵ山形状の反射部材を備えることを特徴とする。

【００２３】（３）（１）または（２）における前記線状光源の上部に　当該線状光源からの光の強度分布を平均化するための遮光・反射手段を備えることを特徴とする。

【００２４】なお、上記構成における線状光源は１本でもよく、また３本以上としてもよい。また、上記遮光・反射手段は一部の光を液晶パネル方向に透過させ　一部の光を液晶パネルとは反対側に反射させる機能を有し、線状光源の長手方向中心から離れるに従って線状光源からの光を遮光・反射する量が減少するようなグラデーションを持たせた多数個のドット状、あるいは多数本の細線状とすることができる。

【００２５】

【発明の実施の形態】以下　本発明の実施の形態につき、実施例を参照して詳細に説明する。

【００２６】図１は本発明による液晶表示装置の第１実施例のバックライトの構成を説明する模式図であって、（ａ）は上面図　（ｂ）は（ａ）のバックライトを液晶パネルに組み込んだ状態を説明する線状光源と直角方向の断面図、（ｃ）は（ａ）の線状光源と平行方向の断面図を示す。

【００２７】同図において、符号１はバックライト全体を示し、２はフレーム、２ａは底部、２ｂは線状光源と平行な側壁、２ｃは線状光源と直角な側壁、３は線状光源（冷陰極蛍光灯）、４は光拡散板である。なお、液晶パネルは光拡散板４の上方に配置されるが、図示を省略してある。

【００２８】この実施例では、線状光源３は２本設置されており、フレーム２の底面２ａ、側壁２ｂおよび２ｃの内面は反射面とされている。

【００２９】線状光源と平行な一対の側壁２ｂは、前記図１１と同様にその内側が前記底部２ａから液晶パネル方向（光拡散板４方向）に向けて開く方向の傾斜面を有する。

【００３０】そして、線状光源３と直交する方向の一対の側壁２ｃの内側は底部２ａから液晶パネル方向に向けて閉じる方向の傾斜面を有することと形成されている。

【００３１】これにより、この側壁２ｃで反射した光は液晶パネルの有効表示領域内に進行し　線状光源３の端部の光量不足を補償して輝度を上げ、均一な輝度分布を得ることができる。

【００３２】図２は本発明による液晶表示装置の第２実施例のバックライトの構成を説明する線状光源と平行方向の要部断面図である。

【００３３】この実施例では、線状光源３と平行な一対の側壁は、第１の実施例と同様にその内側が前記底部２ａから液晶パネル方向（光拡散板４方向）に向けて開く方向の傾斜面を有するが、線状光源３と直交する方向の一対の側壁２ｃの内側は底部２ａから液晶パネル方向に向けて閉じる方向の曲面を有することと形成されている。

【００３４】これにより、この曲面の側壁２ｃで反射した光は液晶パネルの有効表示領域内に進行し、線状光源３の端部の光量不足を補償して輝度を上げ、均一な輝度分布を得ることができる。

【００３５】図３は本発明による液晶表示装置の第３実施例のバックライトの構成を説明する線状光源と平行方向の要部断面図である。

【００３６】この実施例でも、線状光源３と平行な一対の側壁は、第１および第２の実施例と同様にその内側が底部２ａから液晶パネル方向（光拡散板４方向）に向けて開く方向の傾斜面を有するが、線状光源３と直交する方向の一対の側壁２ｃの内側はその途中部分までは液晶パネル方向に垂直であるが、その後は液晶パネル方向に向けて開く方向の傾斜面を有するごとく形成されている。

【００３７】これにより、この曲面の側壁２ｃで反射した光は液晶パネルの有効表示領域内に進行し、線状光源３の端部の光量不足を補償して輝度を上げ、均一な輝度分布を得ることができる。

【００３８】図４は本発明による液晶表示装置の第４実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【００３９】この実施例は、フレーム２の線状光源３と平行な一対の側壁は、第１の実施例と同様にその内側が前記底部２ａから液晶パネル方向（光拡散板４方向）に向けて開く方向の傾斜面を有し、線状光源３と直交する方向の一対の側壁２ｃの内側は図１、図２または図３の何れかと同様の底部２ａから液晶パネル方向に向けて開く方向の傾斜面または曲面とされると共に、当該底部２ａに設置した２本の線状光源３の間に当該各線状光源３からの光を液晶パネル方向に反射する山形形状の反射部材（山形突堤）６を備えている。

【００４０】この山形突堤６を設けたことにより、２本の線状光源の間の輝度不足を補償してさらに均一な照明光分布を得ることが可能となる。なお、山形突堤６の形状は直線傾斜に限らず、曲面傾斜で均一照明光分布はより向上する。

【００４１】図５は本発明による液晶表示装置の第５実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【００４２】この実施例は、フレーム２の線状光源３と平行な一対の側壁は、第１の実施例と同様にその内側が前記底部２ａから液晶パネル方向（光拡散板４方向）に向けて開く方向の傾斜面を有し、線状光源３と直交する方向の一対の側壁２ｃの内側は図１、図２または図３の何れかと同様の底部２ａから液晶パネル方向に向けて開く方向の傾斜面または曲面とされると共に、第４実施例と同様に当該底部２ａに設置した２本の線状光源３の間に当該各線状光源３からの光を液晶パネル方向に反射する反射面を有する反射部材（山形突堤）６を線状光源と平行に備えている。そして、さらに線状光源３の上部に当該線状光源３からの光を一部遮光してフレーム２側に反射させるための遮光・反射部材７を設けたものである。

【００４３】上記遮光・反射部材７は、光拡散板４にアルミニウム材料等の薄膜をトット状あるいは格子状に印刷等で被着することにより形成される。

【００４４】この遮光・反射部材７を設けたことにより、２本の線状光源の上方の輝度の輝度を抑制してさらに均一な照明光分布を得ることが可能となる。

【００４５】また、山形突堤６を設けることで、より一様な照明光の輝度分布を得ることができる。なお、この実施例では、山形突堤６を設けたことは必須ではない。

【００４６】図６は本発明による液晶表示装置の第６実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【００４７】サイズの大きい液晶表示装置である場合は線状光源の本数を増加させる必要があり、この実施例では線状光源３を４本設置した。

【００４８】この実施例は、線状光源３の本数が増加した点を除いて、前記第４実施例と同様である。

【００４９】また、図７は本発明による液晶表示装置の第７実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【００５０】この実施例は、線状光源３の本数が第６実施例と同様に増加した点を除いて、前記第５実施例と同様であり、各線状光源３の上部に当該線状光源３からの光を一部遮光してフレーム２側に反射させるための遮光・反射部材７を設けたものである。

【００５１】上記第６および第７実施例の効果はそれぞれ前記第４および５実施例と同様である。

【００５２】図８は第５および第７実施例の光拡散板に形成する遮光・反射部材の一例を示す一部平面図である。Ｃ－Ｃは線状光源の長手方向中心に相当する。

【００５３】この遮光・反射部材７はＣ－Ｃ上で大径のドットで、このＣ－Ｃ線から当該線状光源から離れる方向に小径のドットとしたものである。

【００５４】このドットの大きさと間隔により液晶パネル方向に出射する光の輝度分布は（ａ）に示したようになり、線状光源の輝度分布が（ｂ）に示したように中心線から左右に離れるに従って減少する特性を補正して（ｃ）のような一様な輝度分布とすることができる。

【００５５】図９と図１０は本発明の実施例の効果を説明するためのフレームの線状光源と直角方向の側壁下部から線状光源の長手方向内側に５０ｍｍまでの輝度分布特性図である。

【００５６】図９は拡散板とフレームの底部の距離を２６ｍｍ、当該側壁が垂直な従来の特性曲線Ａと、側壁下部から有効表示領域側に当該側壁を前記第１実施例の如く３ｍｍ傾斜させた場合の特性曲線Ｂおよび５ｍｍ傾斜させた場合の特性曲線Ｃを示す。

【００５７】特性曲線Ｂ、Ｃを特性曲線Ａと比較して、線状光源と直角方向の側壁を前記実施例の如く傾斜させることで当該線状光源の端部の輝度が上昇することが分かる。

【００５８】また、図１０は線状光源と直角方向の側壁の光拡散板側端部を従来の垂直とした場合に合わせたと

きの図９と同様の傾斜条件で測定した特性曲線を示す。

【００５９】この場合も、特性曲線Ｂ、Ｃを特性曲線Ａと比較して、線状光源と直角方向の側壁を前記実施例の如く傾斜させることで当該線状光源の端部の輝度が上昇することが分かる。

【００６０】また、同図Ｂ′とＣ′は線状光源と直角方向の側壁を前記第３実施例の如く途中で傾斜させた場合の特性曲線を示す。この場合も当該線状光源の端部の輝度がＢとＣより若干低下はするが、従来のＡより上昇することが分かる。

【００６１】このように、本実施例によれば、線状光源の両端領域での輝度低下が補償される。

【００６２】

【発明の効果】以上説明したように、本発明によれば、液晶パネルの背面に１または複数の線状光源を備えた直下型のバックライトを用いた液晶表示装置における線状光源の端部での低輝度を補償し、表示画面の輝度を一様な分布として高品質の画像表示を得ることができる。

【図面の簡単な説明】

【図１】本発明による液晶表示装置の第１実施例のバックライトの構成を説明する模式図である。

【図２】本発明による液晶表示装置の第２実施例のバックライトの構成を説明する線状光源と平行方向の要部断面図である。

【図３】本発明による液晶表示装置の第３実施例のバックライトの構成を説明する線状光源と平行方向の要部断面図である。

【図４】本発明による液晶表示装置の第４実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【図５】本発明による液晶表示装置の第５実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【図６】本発明による液晶表示装置の第６実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【図７】本発明による液晶表示装置の第７実施例のバックライトの構成を説明する線状光源と直交方向の要部断面図である。

【図８】第５および第７実施例の光拡散板に形成する遮光・反射部材の一例を示す一部平面図である。

【図９】本発明の実施例の効果を説明するためのフレームの線状光源と直角方向の側壁下部から線状光源の長手方向内側に５ｍｍまでの輝度分布特性図である。

【図１０】本発明の実施例の効果をさらに説明するためのフレームの線状光源と直角方向の側壁上部から線状光源の長手方向内側に５０ｍｍまでの輝度分布特性図である。

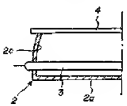
【図１１】直下型バックライトを備えた液晶表示装置の従来の構成例を説明する模式図である。

【符号の説明】

１　バックライト
２　バックライトのフレーム
２ａ　底部
２ｂ　線状光源と平行な側壁
２ｃ　線状光源と直角な側壁
３　線状光源（冷陰極蛍光灯）
４　光拡散板。
５　液晶パネル
６　山形突起
７　遮光・反射部材。

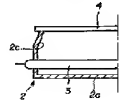
【図２】

図２



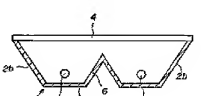
【図３】

図３



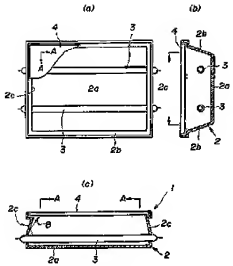
【図４】

図４



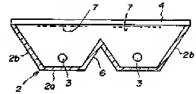
【図1】

図1



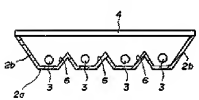
【図5】

図5



【図6】

図6

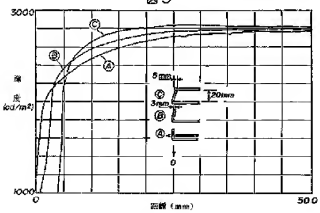


【図7】

図7

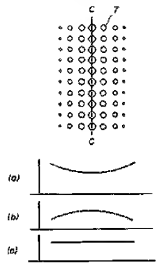
【図9】

図9



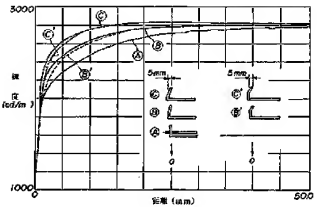
【図8】

図8



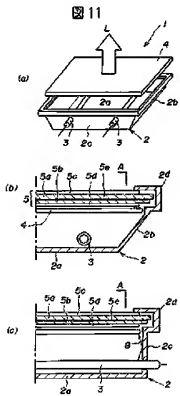
【図10】

図10



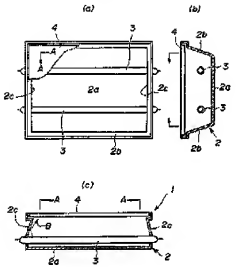
【図11】

図11



【手続補正書】
【提出日】平成１０年６月１９日
【手続補正１】
【補正対象書類名】図面
【補正対象項目名】図１
【補正方法】変更
【補正内容】
【図１】

図１



＊【手続補正２】
【補正対象書類名】図面
【補正対象項目名】図１０
【補正方法】変更
【補正内容】
【図１０】

＊
図１０